MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

Assignment 2	**Math 3202**	Spring 2019

Due: Friday, May 31st, 2019 at 1:00pm. SHOW ALL WORK.

> **Note:** The following textbook problems are useful practice for the topics covered on this assignment:
> - Section 13.2, #s 3–26, 32–40
> - Section 13.3, #s 1–9, 13–16

1. Given $\mathbf{r}(t) = \left\langle \dfrac{1}{\sqrt{9-t^2}}, \dfrac{t}{\sqrt{16+t^2}}, t\cos(\pi t) \right\rangle$, compute each of the following.

   (a) $\mathbf{r}'(t)$

   (b) $\displaystyle\int \mathbf{r}(t)\,dt$

   (c) $\displaystyle\int_0^3 \mathbf{r}(t)\,dt$

2. Let $\mathbf{v}(t) = \langle f(t), g(t) \rangle$. Prove that if $z(t)$ is a scalar function then

$$[z(t)\mathbf{v}(t)]' = z'(t)\mathbf{v}(t) + z(t)\mathbf{v}'(t).$$

3. Given $\mathbf{r}(t) = \langle t^3 - 5t, t^2, -4t \rangle$, find each of the following.

   (a) $\mathbf{T}(2)$, the unit tangent vector at the point $t = 2$

   (b) a parametrisation of the tangent line to $\mathbf{r}(t)$ at $t = 2$

4. Determine whether each of the following curves is smooth for all real numbers t.

   (a) $\mathbf{r}(t) = \langle t^3 - 3t, t^2 - 2t, t^4 - 2t^2 \rangle$

   (b) $\mathbf{r}(t) = \langle t^3 - 3t, t^2 + 2t, t^4 + 2t^2 \rangle$

5. Show that the curves traced out by $\mathbf{r}_1(t) = \langle t, 1-2t, 2t \rangle$ and $\mathbf{r}_2(t) = \langle t^2, -t^2, t^2+1 \rangle$ intersect and determine the <u>cosine</u> of the angle of intersection.

6. Find the length of the curve $\mathbf{r}(t) = \langle 2t^2+1, \frac{3}{2}t^2, t^3 \rangle$ on the interval $0 \leq t \leq 4$.

7. Consider the function $\mathbf{r}(t) = \langle e^t\cos(t), e^t\sin(t), e^t \rangle$ for $t \geq 0$.

   (a) Derive the arclength function $s(t)$.

   (b) Reparametrise $\mathbf{r}(t)$ in terms of its arclength.